IIS Data Quality Visualization Using PowerBI

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NDIIS Manager

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BACKGROUND

North Dakota Immunization Information System (NDIIS)

Web-based version first established in 1996.

Lifespan system that includes records for 100% of ND residents, including all adults 19 and older.

Houses a total of 1.46 million active client records and 19.85 million dose records.

99% of doses are entered within 30 days of administration and 90% of doses are entered within 1 day.

Program Needs

- Data Quality Dashboard completed in September 2022

    - ✓ support IIS program, COVID vaccine program, and VFC program needs

    - ✓ bring in existing data and reports

    - ✓ add additional metrics to monitor IIS data quality and provider data entry

    - ✓ published to state PowerBI service and shared directly with the Immunization Unit Director, Adult/COVID Vaccine Manager, and VFC Program Manager

- Use as much existing data as possible

- Make dashboard updates as easy and efficient as possible

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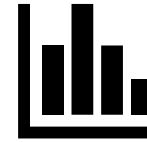Be Legendary.

Bringing data together

Monthly Error Reports

- Assess data entry and administration errors by VFC providers
- VFC Coordinators review and follow-up on corrections

On-Demand COVID Data Entry Monitoring

- As potential issues came up, IIS data was reviewed
- COVID coordinators would review and follow-up on corrections

Quarterly Reports

- Assess provider-level infant, pediatric, adolescent rates for VFC providers
- Sent to providers
- Used by VFC program for annual awards
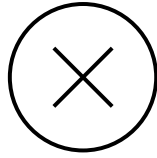
Interoperability Metrics

- Assess data entry for interoperable providers
- Sent to provider and EHR contacts

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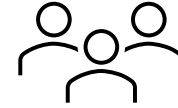Be Legendary.

Additional data

IIS Data Entry Timeliness and Completeness

- Overall and provider-level data entry timeliness
- Demographics and vaccination data completeness by provider
- Adult opt outs

COVID Data Entry Errors

- Provider-level data entry errors specific to COVID doses entered by COVID-enrolled providers

Provider Enrollment and Doses Administered

- IIS, COVID and VFC provider enrollment numbers
- Pediatric doses administered by non-VFC providers for targeted outreach

Vaccine Returns and Wastages

- public vaccine returned by return reason
- public vaccine wasted by wastage reason

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Final Product

- Page 1 – IIS data completeness

- Page 2 – non-COVID vaccine administration and data entry errors

- Page 3 – COVID vaccine administration and data entry error

- Page 4 – timeliness of data entry

- Page 5 – VFC provider coverage rates

- Page 6 – other data metrics

- Page 7 – public vaccine returns and wastages

- Page 8 – interoperability metrics

Dashboard pages can be filtered to:
- *compare multiple months*
- *show metrics by individual provider*
- *show metrics based on COVID or VFC program enrollment status*

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Data Quality Dashboard

Data Entry Completeness

- Updated Monthly
- Requires extracting data from NDIIS and running through SAS
- Assess % complete for required data elements
- Demographic Data Completeness
  - Assess demographic data for clients with doses administered during the calendar month
- Immunization Data Completeness
  - Assess doses administered during the calendar month

- Demographic data elements
  - Client Name (first, middle, last)
  - Race
  - Ethnicity
  - Sex
  - Address (street, state, zip code, county)
  - Email
  - Phone Number
- Dose data elements
  - Lot Number
  - Expiration Date
  - Manufacturer
  - Funding Source
  - Dose Volume
  - Administration Site
  - Administration Route

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NDIIS Data Entry Completeness

Demographics | Immunizations

Immunization Data Completeness

Provider ID	Provider Name	Month, Year	Admin Route	Admin Site	Expiration	Funding	Lot	MVX
4902	ALTRU CLINIC PEDIATRICS	December 2022	100%	100%	100%	100%	100%	100%
4904	ALTRU FAM MED CENTER	December 2022	100%	100%	100%	100%	100%	100%
6004	ALTRU FAMILY MED RESID	December 2022	100%	100%	100%	100%	100%	100%

Filters

Provider Name

Multiple selections

🔍 Search

- [ ] ALTRU BLDG 1
- [ ] ALTRU BLDG 3
- [ ] ALTRU CANDO CARDI...
- [ ] ALTRU CLINIC DRAYTON
- [ ] ALTRU CLINIC LAKE RE...
- [x] ALTRU CLINIC PEDIATRI...
- [ ] ALTRU CPG
- [ ] ALTRU EMPLOYEE HLTH
- [x] ALTRU FAM MED CENT...
- [x] ALTRU FAMILY MED RE...

COVID Enrollment

All

Month, Year

February 2023

Data Entry and Administration Errors for Non-COVID Doses

- Updated monthly
- Uses error report data run for the VFC program
- Expanded to look for errors by all providers, not just VFC-enrolled sites
- Assess doses administered during the calendar month

- Invalid doses administered
- Combination and single antigen vaccine given the same day
- Expired doses administered
- Administered doses entered as historical
- Unspecified vaccines entered as administered
- Dose date same as birthdate (non-Hep B)
- Administered vaccine not on market
- OPV administered after 4/1/2016
- Non-routine vaccine entered as public funding
- Publicly funded doses with Not Eligible VFC status
- Adult doses administered marked as public funding source
- DTaP given after age 6
- Hepatitis A given before 1 year
- Adult presentation given to under 18
- Adult presentation given to under 18
- Hib given after age 5
- HPV given before age 9
- MMR, Varicella given before age 1
- PPSV23 given before age 2
- Rotavirus given after 8 months
- Td/Tdap given before age 7
- Monkeypox given before age 18
- HPV given after age 45 years

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NDIIS Data Entry & Vaccine Administration Errors for Non-COVID Vaccines

Filters

Provider Name

All

Provider ID

All

VFC Enrollment

All

COVID Enrollment

All

Month, Year

February 2023

| | | All Ages | Pediatric (0-18) | Adult (19+) |

All Ages Errors

Provider ID	Provider Name	Invalid doses administered	Combo and single antigen given same day	Expiration date exceeded for the specified lot number	Administered doses entered as historical
3	CITY-COUNTY HEALTH DISTRIC	0	0	0	0
4	LRDHU BENSON COUNTY	0	0	1	0
5	SWDHU BILLINGS/GLDN VALLEY	0	0	0	0
6	FIRST DISTRICT - BOTTINEAU	0	0	0	0
7	SWDHU BOWMAN/SLOPE	0	0	0	0
8	FIRST DISTRICT - BURKE	0	0	0	0
9	FIRST DISTRICT - WARD CNTY	0	0	0	0
10	BISMARCK-BURLEIGH PUB HLT	1	0	0	0
11	FARGO CASS PUBLIC HEALTH	0	0	0	0
12	CAVALIER CNTY HEALTH DIST	0	0	0	0
14	UMDHU CROSBY	0	0	0	0
15	SWDHU DUNN COUNTY	0	0	0	0
16	LRDHU EDDY COUNTY	0	0	0	0
18	GRAND FORKS PUBLIC HEALTH	0	0	0	0
19	CUSTER HEALTH GRANT CNTY	0	0	0	0
20	NELSON-GRIGGS DIST HLTH	0	0	0	0
21	SWDHU HETTINGER CO	0	0	0	0
23	FIRST DISTRICT - MCHENRY	0	0	0	0
24	UMDHU WATFORD CITY	0	0	0	0
25	FIRST DISTRICT - MCLEAN	0	0	0	0
27	CUSTER HEALTH - MORTON CO	0	0	0	0
28	UMDHU - STANLEY	0	0	0	0
29	PEMBINA CO HEALTH DEPT	0	0	0	0

Data Entry and Administration Errors for COVID Doses

- Updated monthly
- Requires extracting data from NDIIS and running through SAS
- Assess number of COVID vaccine doses entered during the calendar month with data entry or administration errors

- Invalid lot number documented
- Invalid manufacturer documented
- Invalid expiration date documented
- Dose administration date before 12/14/2020
- Vaccine given outside authorized age group
- Non-US vaccine entered as administered
- Expired dose administered
- Unspecified vaccine entered as administered
- Monovalent vaccine booster given after 8/31/2022
- Bivalent vaccine given as primary series dose

Completeness | Non COVID Errors | COVID Errors | Timeliness | Coverage Rates | Other Data | Returns & Wastages | Interoperability

NDIIS Data Entry & Vaccine Administration Errors for COVID-19 Vaccines

Filters

Provider Name

All ∨

Provider ID

All ∨

COVID Enrollment

Enrolled ∧

🔍 Search
■ Enrolled
☐ Not Enrolled

Doses are counted as having an invalid manufacturer when the manufacturer documented in the dose record does not match the correct manufacturer for the vaccine type given.

Doses are counted as having an invalid expiration date if the date documented in the dose record is before 12/14/2020 or after 12/31/2023.

Provider ID	Provider Name	Invalid Lot Number	Invalid Manufacturer	Invalid Expiration Date	Dose Date before 12/14/2020	Vaccine Given Outside Authorized Age Group	Non US Vaccine Entered as Administer
3	CITY-COUNTY HEALTH DISTRIC	0	0	0	0	1	0
4	LRDHU BENSON COUNTY	0	0	0	0	0	0
5	SWDHU BILLINGS/GLDN VALLEY	0	0	0	0	0	0
6	FIRST DISTRICT - BOTTINEAU	0	0	0	0	2	0
8	FIRST DISTRICT - BURKE	0	0	0	0	0	0
9	FIRST DISTRICT - WARD CNTY	0	0	0	0	0	0
10	BISMARCK-BURLEIGH PUB HLT	2	17	6	0	7	0
11	FARGO CASS PUBLIC HEALTH	2	6	14	0	7	0
12	CAVALIER CNTY HEALTH DIST	0	2	0	0	4	0
14	UMDHU CROSBY	0	6	1	0	3	0
16	LRDHU EDDY COUNTY	6	4	1	1	4	0
18	GRAND FORKS PUBLIC HEALTH	1	22	2	0	12	0
19	CUSTER HEALTH GRANT CNTY	0	0	1	0	0	0
20	NELSON-GRIGGS DIST HLTH	0	1	0	0	3	0
23	FIRST DISTRICT - MCHENRY	0	0	0	0	0	0
24	UMDHU WATFORD CITY	0	2	0	0	3	0
25	FIRST DISTRICT - MCLEAN	0	0	0	0	0	0
27	CUSTER HEALTH - MORTON CO	0	3	2	0	0	0
28	UMDHU - STANLEY	37	0	1	0	4	0
29	PEMBINA CO HEALTH DEPT	0	0	30	0	4	0
30	LRDHU PIERCE CO	1	4	0	0	0	0
31	LRDHU RAMSEY CO	0	0	2	0	4	0
32	RANSOM CO HEALTH DEPT	0	4	2	0	0	0
33	FIRST DISTRICT - RENVILLE	0	1	1	0	0	0
Total		**4,065**	**3,544**	**2,467**	**8**	**681**	

Data Entry Timeliness

- Updated monthly

- Uses raw data file extracted from NDIIS without running separate SAS analysis

- Assess doses administered during the calendar month

- Evaluates the number of days between administration and entry into the IIS

- % of doses administered during month entered into the IIS within:
  - 1 day
  - 1 to 7 days
  - 7 to 14 days
  - 15 to 30 days
  - more than 30 days

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NDIIS Data Entry Timeliness

Percent of Doses Entered within 30 Days 100%

Overall Timeliness   Timeliness by Provider

Data Entry Timeliness by Provider

● 1 day ● 1-7 days ● 7-14 days ● 15-30 days ● More than 30 days

Filters

Provider Name
All

Provider ID
All

VFC Enrollment
All

COVID Enrollment
All

Month Year
February 2023

Provider	
ALTAIRE CLINIC	
ALTRU APC	
ALTRU CLINIC DRAYTON	
ALTRU CLINIC LAKE REGIO	
ALTRU CLINIC PEDIATRICS	
ALTRU EMPLOYEE HLTH	
ALTRU FAM MED CENTER	
ALTRU FAMILY MED RESID	
ALTRU FAMILY MED SOUTH	
ALTRU HLTH CLINIC-3D	
ALTRU HME HLTH GRAFTON	
ALTRU HOSPITAL	
ALTRU INFECTIOUS DIS	
ALTRU INTERNAL MEDICINE	
ALTRU MAIN CLINIC	
ALTRU OB/GYN	
ALTRU OCCUPATIONAL MED	
ALTRU REHABILITATION	
ALTRU RENAL DIALYSIS	
ALTRU SPECIALTY CENTER	
AMEND HEALTH CARE	
ANETA PARKVIEW HLTH CTR	
ANOVA FAMILY MED CTR	
ARTHUR DRUG	
ASHLEY MED CTR CLINIC	
AUGUSTA PLACE	

0%   100%

VFC Provider Coverage Rates

- Updated quarterly
- Uses rates data assessed for coverage reports sent to VFC-enrolled providers
  - No additional analysis is needed
- Includes provider patient population
- Used by VFC program to prioritize VFC and IQIP site visits
- Used for annual immunization provider awards

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Infant rates for 24–35-month-olds up-to-date by 24 months
- 4:3:1:U:3:1:U series
- 4 DTaP
- 3 polio
- 1 MMR
- 3 hepatitis B
- Hib up-to-date
- 1 varicella
- PCV up-to-date
- 2 hepatitis A

Pediatric rates for 6-year-olds
- 5:4:2:3:2 series
- 5 DTaP
- 4 polio
- 2 MMR
- 3 hepatitis B
- 2 varicella

Adolescent rates for teens 13-15-years old up-to-date by 13 years
- 1 Tdap
- 1 MCV4
- HPV up-to-date
- 2 varicella
- 2 MCV4 (16-17 years)

VFC Provider Coverage Rates

Filters

Provider Name

All ▼

Provider ID

All ▼

Quarter

Q4 2022 ▼

Infant data = kids 24-35 months of age as of the end of the quarter who were up-to-date before turning 24 months.

Pediatric data = kids 6 years of age as of the end of the quarter who were up-to-date before the end of the quarter.

Adolescent data = teens 13-15 years of age who were up-to-date before turning 13 years.

Data for 2 doses of MCV4 are for teens 16-17 years of age.

Patient Populations | **Infant Rates** | **Pediatric Rates** | **Adolescent Rates**

Infant Coverage Rates

Provider ID	Provider Name	4:3:1:U:3:1:U Series	4+ DTaP	3+ Polio	1+ MMR	3+ Hep B	Hib UTD	1+ Vari
3	CITY-COUNTY HEALTH DISTRIC	28.6%	85.7%	100.0%	85.7%	100.0%	57.1%	85.7%
4	LRDHU BENSON COUNTY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
5	SWDHU BILLINGS/GLDN VALLEY	0.0%	33.3%	66.7%	100.0%	66.7%	33.3%	66.7%
6	FIRST DISTRICT - BOTTINEAU	90.9%	100.0%	100.0%	100.0%	100.0%	90.9%	100.0
9	FIRST DISTRICT - WARD CNTY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
10	BISMARCK-BURLEIGH PUB HLT	87.5%	100.0%	100.0%	100.0%	100.0%	87.5%	100.0
11	FARGO CASS PUBLIC HEALTH	22.2%	33.3%	66.7%	77.8%	77.8%	55.6%	77.8%
12	CAVALIER CNTY HEALTH DIST	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
13	AVERA CLINIC	66.7%	83.3%	83.3%	83.3%	83.3%	66.7%	83.3%
14	UMDHU CROSBY	69.2%	80.8%	92.3%	88.5%	96.2%	69.2%	88.5%
15	SWDHU DUNN COUNTY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
16	LRDHU EDDY COUNTY	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
18	GRAND FORKS PUBLIC HEALTH	0.0%	0.0%	100.0%	100.0%	100.0%	0.0%	100.0
19	CUSTER HEALTH GRANT CNTY	50.0%	75.0%	100.0%	100.0%	100.0%	100.0%	100.0
20	NELSON-GRIGGS DIST HLTH	80.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
21	SWDHU HETTINGER CO	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
23	FIRST DISTRICT - MCHENRY	0.0%	100.0%	50.0%	50.0%	50.0%	50.0%	50.0%
24	UMDHU WATFORD CITY	60.0%	72.0%	96.0%	96.0%	88.0%	64.0%	96.0%
25	FIRST DISTRICT - MCLEAN	50.0%	100.0%	100.0%	100.0%	100.0%	100.0%	50.0%
27	CUSTER HEALTH - MORTON CO	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0
28	UMDHU - STANLEY	66.7%	66.7%	88.9%	88.9%	100.0%	77.8%	88.9%
29	PEMBINA CO HEALTH DEPT	80.0%	100.0%	100.0%	100.0%	100.0%	80.0%	100.0
30	LRDHU PIERCE CO	76.9%	92.3%	92.3%	92.3%	92.3%	92.3%	84.6%
31	LRDHU RAMSEY CO	85.7%	90.5%	95.2%	100.0%	100.0%	95.2%	100.0%

Other Data Quality Metrics

- Updated monthly
- Metrics are populated from raw data files extracted from NDIIS without having to run separate SAS analysis
- Provider enrollment numbers look for VFC-enrolled sites, COVID-enrolled sites, and all ND provider sites active in the IIS
- Adult opt outs are the number of adult records marked as opted out in the IIS
- Pediatric doses administered was requested by VFC program
  - Identify providers giving vaccine to kids but not enrolled in the VFC program for targeted provider outreach

Enrollment

- VFC enrolled sites are flagged in their IIS provider record
- COVID enrollment data is exported when updated enrollment is run for submission to the CDC IZDL
- IIS enrollment is based on provider status and physical address as entered in their IIS provider record

Adult Opt Out

- Adults 19 and older can choose to opt out of the IIS
- Records are not removed from the IIS but are not searchable by users, do not return results in an RSP message, and no new data can be entered

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Other NDIIS Data Quality Metrics

Provider Enrollment

VFC Enrolled Providers	COVID Enrolled Providers	All ND Providers
203	416	875

Adult Opt Outs

Total Adults Opted Out	Min Age at Opt Out	Max Age at Opt Out	Average Age at Opt Out
86	17	87	41

Number of Adults Opted Out of NDIIS by Month
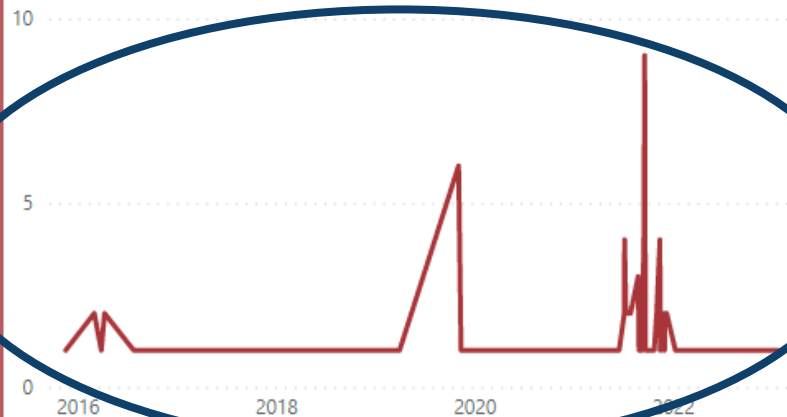
Pediatric Doses Administered

VFC Enrollment
- [ ] Enrolled
- [ ] Not Enrolled

Dose Date
1/1/2022 — 2/28/2023

Provider ID
All

Provider Name
All

Total Doses

408,734

Pediatric Doses by Vaccine

INFL (IIV4 P/F)
PCV13 (pneumococ...
ROTAVIRUS (3 dose)
HAV Pediatric
COVID19 Pfizer-TRI...
HPV-9
HBV Pediatric
DTaP-Hib-IPV (Pent...
MMRV
COVID19 Pfizer-TRI...
DTaP/IPV/Hib/HBV
Tdap
DTAP/IPV

0   20,000   40,000   60,000
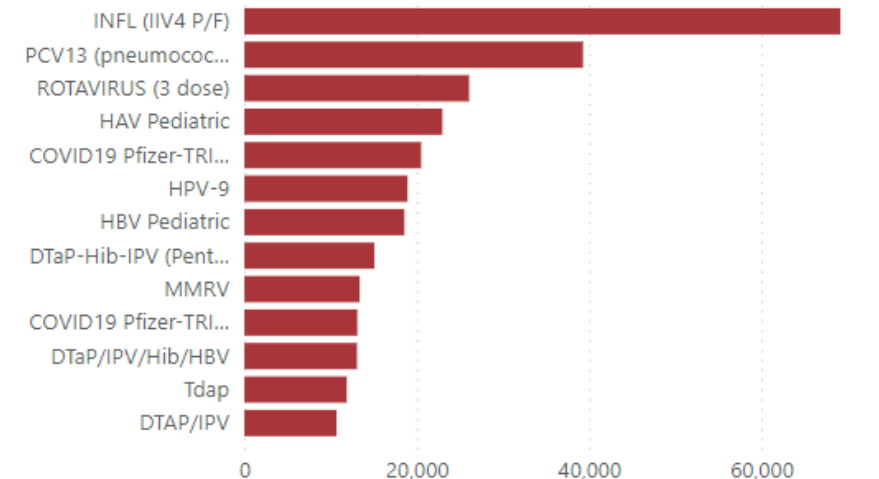
Returns and Wastages

- Updated monthly
- Uses public vaccine return and wastage data entered in the NDIIS ExIS module
- Metrics are populated from raw data files extracted from NDIIS without having to run separate SAS analysis

- Includes vaccine returns and wastages for non-COVID vaccines
- Includes doses returned or wasted during the currently grant budget year (July – June)

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Public Vaccine Returns & Wastages

Filters

Date

| 7/1/2022 | 2/28/2023 |

🔍 Search
- [ ] DT
- [ ] DTAP
- [ ] DTAP - 5
- [ ] DTaP/HIB
- [ ] DTAP/IPV
- [x] DTaP/IPV/Hib/HBV
- [ ] DTaP-HBV-IPV (Pediarix)
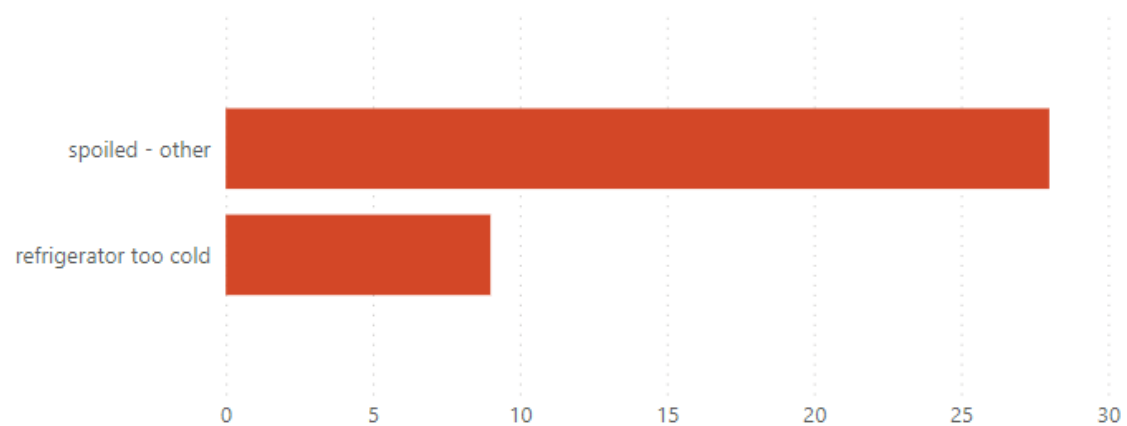- [ ] DTaP-Hib-IPV (Pentacel)
- [ ] HAV Adult
- [ ] HAV Pediatric

DTaP/IPV/Hib/HBV ⌃

Vaccine Returns

Total Doses Returned

37

Doses Returned by Reason

- spoiled - other
- refrigerator too cold

0   5   10   15   20   25   30

Vaccine Wastages

Total Doses Wasted

23

Doses Wasted by Reason

- open vial but not all dose...
- broken vial/syringe
- vaccine drawn but not ad...

0   5   10   15   20
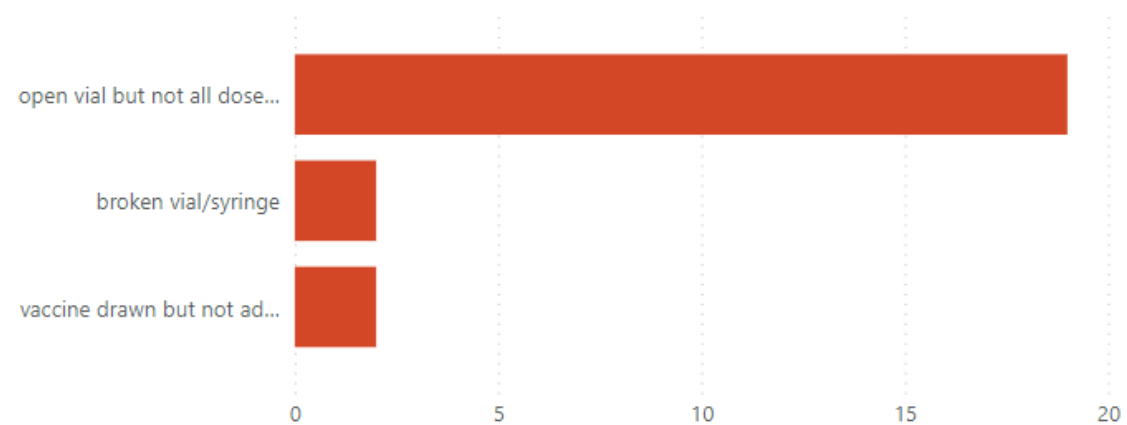
Interoperability

- Updated quarterly
- Uses data routinely assessed for interop report cards
- Does require entry of messaging data into data table and running a small SAS code file
- Data quality and data entry metrics show comparison between interoperable providers/health systems/provider groups and non-interoperable providers

Data points include:

- Number of sites
- Number of different EHRs vendors
- Total VXU messages
- Total QBP messages
- Percent of VXU messages with errors
- Percent of bi-directional connections
- Percent of connections via state-wide HIE
- Doses administered by provider group
- Duplicate/fragmented person records created
- Data entry timeliness
- Messages received by month

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NDIIS Interoperability

Month

December 2022 ▲

- ☐ May 2022
- ☐ June 2022
- ☐ July 2022
- ☐ August 2022
- ☐ September 2022
- ☐ October 2022
- ☐ November 2022
- ☑ December 2022
- ☐ January 2023
- ☐ February 2023
- ☐ March 2023

VXU message contains information on administered or historical immunization.

Number of Interoperable Sites

490

Total VXU Messages

80,952

Total Query Messages

824,196

EHR Vendors Connected

25

Percent of VXU Errors

1.0%

Real Time Bi-Directional

84.1%

Connections via NDHIN

71.6%

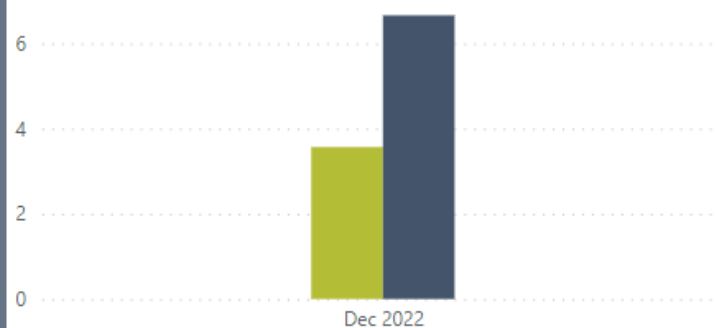## Doses Administered by Provider Group

● 18 and younger ● 19 and older

- Sanford - North
- Sanford - West
- Altru Health
- Essentia Health
- Trinity Health
- Interoperable LP...
- Non Interoperab...
- Essentia MidDak...

0K   10K   20K
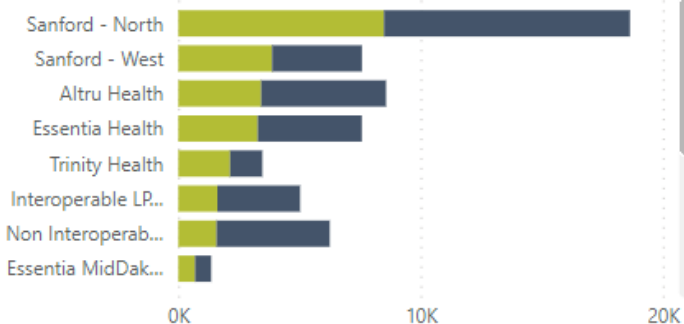
Duplicate Client Records Created

- Sanford - North
- Interoperable Pha...
- Sanford - West
- Essentia Health
- Altru Health
- Interoperable LPHU
- Veterans Health
- CHI St Alexius Cli...
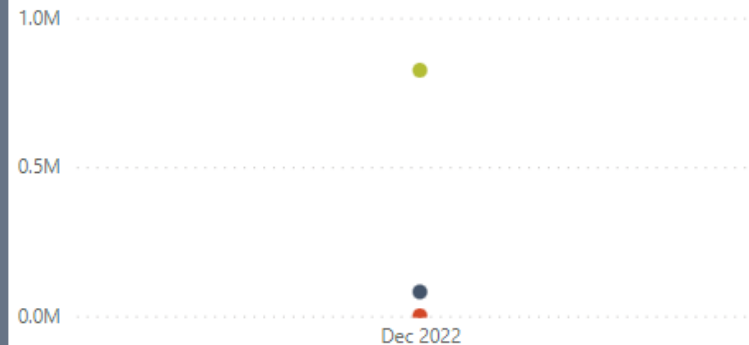- Trinity Health

0   50   100
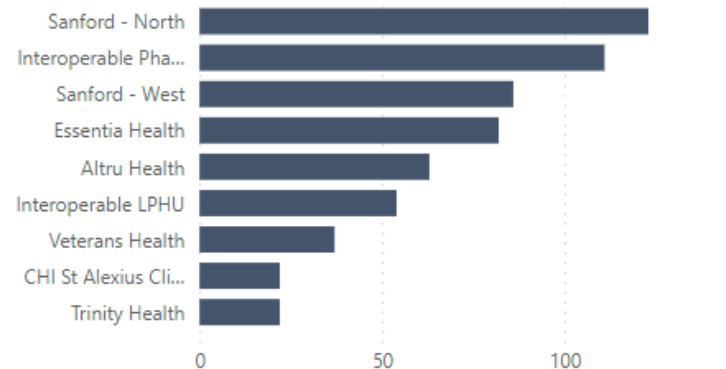
Average Days to Enter Doses Administered

● interoperable ● not interoperable

6

4

2

0

Dec 2022

HL7 Messages by Month

● VXU Messages ● VXU Errors ● QBP Messages

1.0M

0.5M

0.0M

Dec 2022

Programmatic Use

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Programmatic Uses

- Data reviewed monthly by unit director and program managers
- Have used dashboard to identify data clean-up activities
  - COVID coordinators currently working with providers on fixing invalid lot numbers and expiration dates
- Interoperability metrics used for grant reporting
- Built additional dashboards using data pulled together for data quality dashboard
  - ✓ Public-facing interoperability dashboard
  - ✓ Immunization dashboard for Medicaid Health Tracks program

Participating Providers

Provider List   **Provider Map**

Connection Status

- ☑ Select all
- ☑ In Production
- ☐ In Queue
- ☐ Technical Testing

Provider Sites

490

EHR Vendors Connected

25

Providers listed as In Queue have submitted their registration of intent to connect to the NDIIS and are currently awaiting to begin the formal on-boarding and technical testing process.

Providers listed as Technical Testing have completed their initial on-boarding and have started submitting HL7 test messages to the NDIIS for validation.

Providers listed as In Production have completed all testing and validation and have achieved on-going submission of immunization messages from their EHR to the NDIIS production environment.

Connection Status ● In Production

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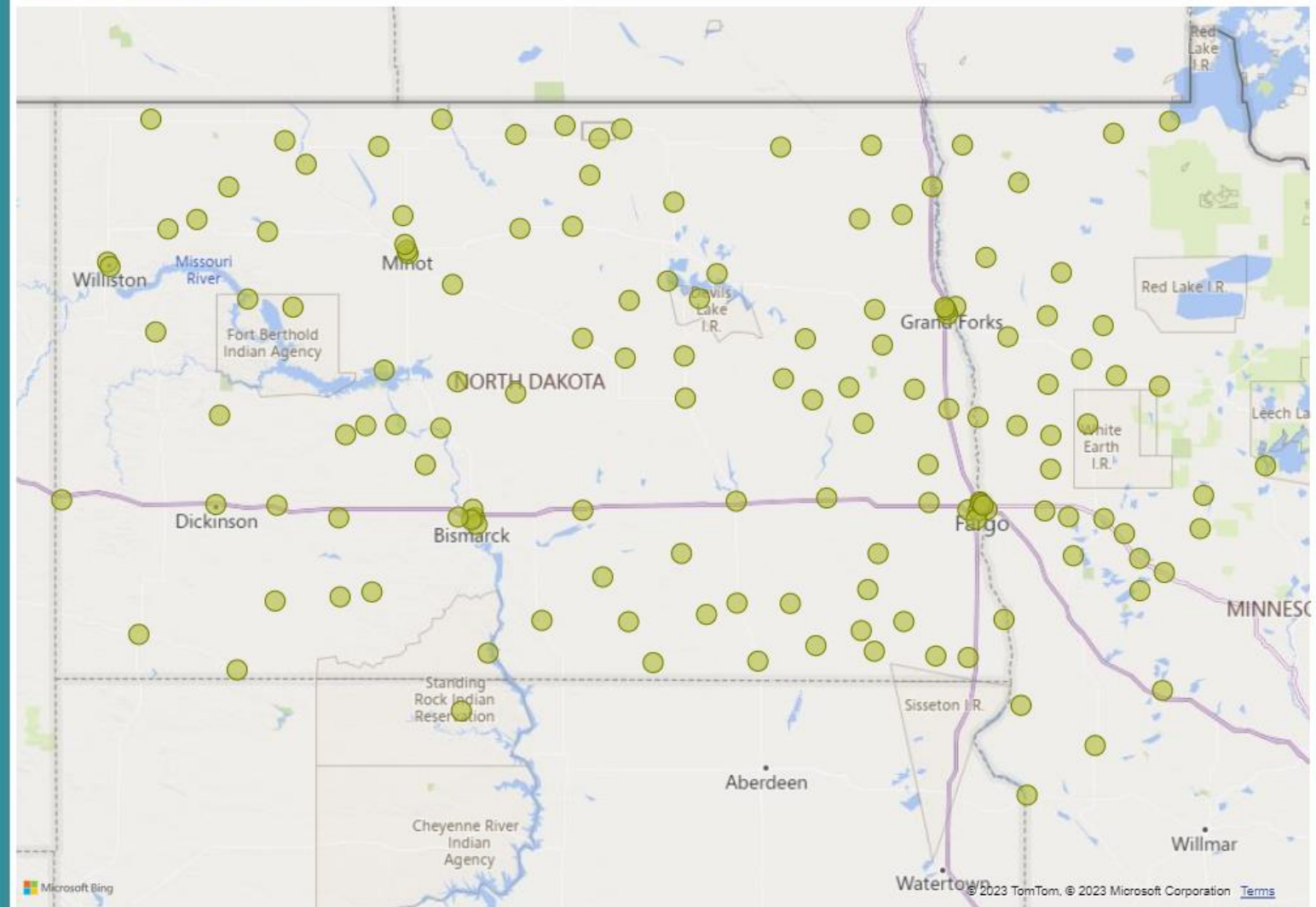
Thank You!

Huge thanks to:

⭐ **Olenka Aguilar** *for helping create the dashboard and completing the monthly dashboard updates*

⭐ **Melissa Anderson** *for completing the monthly dashboard updates*

Q&A session
Following breakout session presentations

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